

Nick Borcharding

Curriculum Vita

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Education and Professional Experiences

- 2020-Present **Clinical Pathology Resident**, *Department of Pathology and Immunology, Washington University*
- 2014-2020 **MD**, *University of Iowa Carver College of Medicine*
- 2014-2020 **PhD**, *University of Iowa Carver College of Medicine*
Cancer Biology Graduate Program
- 2012-2014 **MS**, *University of Iowa Carver College of Medicine*
Pathology Graduate Program
- 2009-2012 **BS**, *Iowa State University*, summa cum laude
Nutritional Sciences

Publications

- [1] Subramani, S., Bellizzi, A., **Borcharding, N.**, Kao, S., Dillon, J., Howe, J., Norris, A.N., Tansey, M., & Pinnaro, C. (2021) Hypoglycemia secondary to insulinoma masking the onset of type 1 diabetes in an adolescent. *Clinical Case Reports*. In Press.
- [2] Kim, M.*, **Borcharding, N.***, Ahmed, K.A.*, Voigt, A.P., Vishwakarma, V., Kolb, R., Kluz, P., Pandey, G., De, U., Drashansky, T., Helm, E.Y., Zhang, X., Gibson-Corley, K.N., Klesney-Tait, J., Zhu, Y., Lu, J., Lu, J., Huang, X., Xiang, H., Cheng, J., Wang, D., Wang, Z., Tang, J., Hu, J., Wang, Z., Liu, H., Li, M., Zhuang, H., Avram, D., Zhou, D., Bacher, R., Zheng, S., Wu, X., Zakharia, Y., Weizhou Zhang, W. (2020). CD177 modulates the function and homeostasis of tumor-infiltrating regulatory T cells. *Nature Communications*. In Press. *co-primary authors
- [3] Reynolds, D., Vazquez Guillamet, C., Day, A., **Borcharding, N.**, Vazquez Guillamet, R., Chorenó-Parra, J.A., House, S.L., O'Halloran, J.A., Zuniga, J., Ellebedy, A.H., Byers, D.E., Mudd, P.A. (2021) Comprehensive immunologic evaluation of bronchoalveolar lavage samples from human patients with moderate and severe influenza and severe COVID-19. *Journal of Immunology*. PMID: 34348975
- [4] Amanat, F., Thapa, M., Lei, T., Sayed, Ahmed, S.M., Adelsberg, D., Cerreno, J.M., Strohmeier, S., Schmitz, A.J., Zafar, S., Zhou, J.Q., Rejnink, W., Alshammari, H. **Borcharding, N.**, Reiche, A.G., Strivastava, K., Sordillo, E., van Bakel, H., The Personalized Virology Initiative, Bajic, G., Simon, V., Ellebedy, A.H., & Krammer, F. (2021). SARS-CoV-2 mRNA vaccination induces functionally diverse antibodies to NTD, RBD, and S2. (2021) *Cell*. PMID: 34192529.
- [5] **Borcharding, N.** & Gronowski, A. Commentary on a case of Unexpected Hyperglycemia. (2021). *Clinical Chemistry*. PMID: 34352082.
- [6] Merritt, N., Garcia, K. Rajendran, D., Lin, Z.Y., Zhang, X., Mitchell, K., **Borcharding, N.**, Fullenkamp, C., Chimenti, M., Gingras, A.C., Harvey, K., & Tanas, M. (2021) TAZ-CAMTA1 and YAP3-TFE3 alter TAZ/YAP transcriptome by recruiting the ATAC histone acetyltransferase complex. *eLife*. PMID: 33913810.

- [7] Mathew, N.R., Jayanthan, J.K., Smirnov, I., Robinson, J.L. Axelsson, H., Nakka, S.S., Emmanouilidi, A., Czarnewski, P., Yewdell, W.T., Lebrerio-Fernandez, C, Bernasconi, V., Rodin, W., Harandi, A.M, Lycke, N., **Borcherding, N.**, Yewdell, J.W., Greiff, V., Bemarker, M., & Angeletti, D., (2021) Single-cell BCR and transcriptome analysis influenza infection reveals spatiotemporal dynamics of antigen-specific B cell response. *Cell Reports*. [PMID: 34161770](#).
- [8] Kolb, R., De, U., Khan, S., Luo, Y., Kim, M., Yu, H., Wu, C., Zhang, X., Zhang, X., **Borcherding, N.**, Zheng, G., Zhou, D., & Zhang, W. (2021). Proteolysis-targeting chimera against BCL-XL destroys tumor-infiltrating regulatory T cells. *Nature Communications*. [PMID 33627663](#).
- [9] **Borcherding, N.***, Vishwakarma, A.*, Voigt, A.P., Nepple, K., Salem, A., Jenkins, R.W., Zhang, W., Zakharia, Y. (2021) Mapping the immune environment in clear cell renal carcinoma by single-cell genomics. *Communications Biology*. [PMID: 33504936](#). *co-primary authors
- [10] Cheng, Y., **Borcherding, N.**, Ogunsakin, A., Lemke-Miller, C.D., Gibson-Corley, K.N., Rajan, A., Wongpattaraworakul, W., Chan, C.H., Salem, A.K., Weiner, G.J., Simons, A.L. (2021). The anti-tumor effects of cetuximab in combination with motolimod are T cell dependent. *Scientific Reports*. [PMID: 33452311](#).
- [11] Gu, V.W., Cho, E., Thompson, D.T., Cassady, V., **Borcherding, N.**, Koch, K.E., Wu, V.T., Lorenzen, A.W., Kulak, M.V., Williams, T., Zhang, W., Weigel, R.J. (2021). AP-2 γ is Required for Maintenance of Multipotent Mammary Stem Cells. *Stem Cell Reports*. [PMID 33382976](#).
- [12] Swami, U., Chennamadhavuni, A., **Borcherding, N.**, Bossler, A.D., Mott, S.L., Garje, R., Zakharia, Y., & Milhem, M.M. (2020). Multivariate analysis of 169 cases of advanced cutaneous melanoma to evaluate antibiotic exposure as a predictor of survival to anti-PD-1 based immunotherapies. *Antibiotics*. [PMID: 33120998](#).
- [13] **Borcherding, N.**, Jethava, Y., Vikas, P. (2020). Repurposing anti-cancer drugs for COVID-19. *Drug Design, Development and Therapy*. [PMID 33239864](#).
- [14] Renavikar, P.S., Sinha, S., Brate, A.A., **Borcherding, N.**, Crawford, M.P., Steward-Tharp, S., & Karandikar, N. (2020). IL-12-Induced Immune Suppressive Deficit During CD8+ Differentiation. *Frontiers in Immunology*. [PMID: 33193343](#).
- [15] Crawford, M.P., Sinha, S., Renavikar, P.S., **Borcherding, N.**, & Karandikar, N. (2020). Novel role for the T-helper 17 signature cytokine IL-17: CD4 resistance to immune suppression. *Proceedings of the National Academy of Sciences*. [PMID: 32719138](#).
- [16] **Borcherding, N.**, Crotts, S.B., Ortolan, L.S., Bormann, N.L., Jabbari, A. (2020). A transcriptomic map of murine and human alopecia areata. *Journal of Clinical Investigations Insights*. [PMID: 32453712](#).
- [17] Vikas, P.*, **Borcherding, N.***, Chennamadhabani, A., Garje, R. (2020). Therapeutic potential of combining PARP inhibitor and immunotherapy in solid tumors. *Frontiers in Oncology*. [PMID: 32457830](#). *co-primary authors
- [18] Kluz, P.N., Kolb, R., Xie, Q., **Borcherding, N.**, Liu, Q., Wang, L., Zhang, Y., Li, W., Stipp, C., Gibson-Corley, K.N., Zhao, C., Qi, H.H., Bellizzi, A., Tao, A.W., Sugg, S., Weigel, R.J., Shen, X., Zhang, W. (2020). Cancer cell-intrinsic function of CD177 in attenuating β -Catenin signaling. *Oncogene*. [PMID: 32042113](#).
- [19] **Borcherding, N.***, Bormann, N., & Kraus, G. (2020). scRepertoire: A R-based toolkit for single-cell immune receptor analysis. *F1000Research*. [PMID: 32789006](#). *corresponding author
- [20] Liu, Q., **Borcherding, N.**, Shao, P., Maina, P., Zhang, W., & Qi, H. (2019). Contribution of synergism between PHF8 and HER2 signaling to breast cancer development and drug resistance. *EBioMedicine*. [PMID: 31923801](#).

- [21] Xiu, Y., Qianze Dong, Q., Fu, L., Bossler, A., Tang, X., Boyce, B., **Borcherding, N.**, Byrd, J., Leidinger, M., Sardina, J.L., Xue, H., Li, Q., Feldman, A., Aifantis, I., Boccalatte, F., Khoury, J., Wang, W., Hu, S., Yuan, Y., Wang, E., Yuan, J., Colgan, J., Habelhah, H., Waldschmidt, T., Muschen, M., & Zhao, C. (2020). Concurrent activation of NF- κ B and Notch signaling is sufficient to induce B cell transformation and enables B-myeloid conversion. *Blood*. [PMID: 31697816](#).
- [22] Wu, V., Kiriazov, B., Koch, K., Gu, V., Beck A., **Borcherding, N.**, Li, T., Addo, P., Wehrspan, Z., Zhang, W., Braun, T., Brown, B., Band, V., Band, B., Kulak, M., & Weigel, R. (2020). A TFAP2C Gene Signature is Predictive of Outcome in HER2-positive Breast Cancer. *Molecular Cancer Research*. [PMID: 31619506](#).
- [23] Bi, J., Yang, S., Li, L., Dai, Q., **Borcherding, N.**, Wagner, B.A., Buettner, G.R., Spitz, D.R., Leslie, K.K., Zhang, J., & Meng, X. (2019). Metadherin (MTDH) Enhances Vulnerability of Cancer Cells to Ferroptosis. *Cell Death and Disease*. [PMID: 31527591](#).
- [24] Liu, Q.*, **Borcherding, N.***, Shao, P., Cao, H., Zhang, W., & Qi, H. (2019). Identification of novel TGF- β regulated genes with pro-migratory roles. *Molecular Basis of Disease*. [PMID: 31449970](#). *co-primary authors
- [25] Pandey, G.*, **Borcherding, N.***, Kolb, R., Kluz, P., Li, W., Sugg, S., Zhang, J., Lai, D., & Zhang W. (2019). ROR1 potentiates FGFR signaling in basal-like breast cancer. *Cancers*. [PMID: 31137681](#). *co-primary authors
- [26] **Borcherding, N.**, Voigt, A., Liu, V., Link, B.K., Zhang, W., & Jabbari, A. (2019) Single-cell profiling of cutaneous T-cell lymphoma reveals underlying heterogeneity associated with disease progression. *Clinical Cancer Research*. [PMID: 30718356](#).
- [27] Kolb, R., Kluz, P., Wei, T.Z., **Borcherding, N.**, Bormann, N., Balczak, L., Zhu, P., Davies, B., Gourronc, F., Gibson-Corley, K. Klingelhutz, A., Tan, N.S., Sutterwala, F., Vishwakarma, A., Liu, L., Ge, X., Jiang, B., Zhu, Y., Shen, X., & Zhang, W. (2019). Obesity-associated inflammation promotes angiogenesis and breast cancer via angiopoietin-like 4. *Oncogene*. [PMID: 30518876](#).
- [28] Vikas, P., **Borcherding, N.**, & Zhang, W. (2019). The Clinical Promise of Immunotherapy in Triple-Negative Breast Cancer. *Clinical Management and Research*. [PMID:30573992](#).
- [29] **Borcherding, N.**, Bormann, N., Voigt, A., & Zhang, W. (2018). TRGAted: A web tool for survival analysis using protein data in the Cancer Genome Atlas. *F1000Research*. [PMID: 30345029](#).
- [30] **Borcherding, N.***, Cole, K.*, Kluz, P., Pandey, G., Jorgensen, M., Kolb, R., Bellizzi, A., & Zhang, W. (2018). Reevaluating E-Cadherin and β -Catenin: A pan-cancer proteomic approach with emphasis on breast cancer. *American Journal of Pathology*. [PMID: 29879416](#). *co-primary authors
- [31] **Borcherding, N.**, Kolb, R., Gullicksrud, J., Vikas, P. Zhu, Y., & Zhang, W. (2018). Keeping tumors in check: A mechanistic review of clinical response and resistance to immune checkpoint blockade in cancer. *Journal of Molecular Biology*. [PMID: 29800567](#).
- [32] Sinha, S., **Borcherding, N.**, Renavikar, P., Crawford, M., & Karandikar. (2018). Autoimmune disease risk SNP rs2281808 in Sirpy is associated with heightened effector state and greater cytotoxic potential in human CD8 T-cells. *Scientific Reports*. [PMID: 30337675](#).
- [33] Xiu, Y., Li, Q., Li, F., Boyce, B., **Borcherding, N.**, Xue, X., & Zhao, C. (2017). Stabilization of NF- κ B-inducing kinase suppresses MLL-AF9-induced acute myeloid leukemia. *Cell Reports*. [PMID: 29320732](#).
- [34] Liu, Q., Kulak, M., **Borcherding, N.**, Maina, P., Zhang, W., Weigel, R., & Qi, H. (2017). A novel *HER2* gene-body enhancer contributes to *HER2* expression. *Oncogene*. [PMID: 29035388](#).

- [35] Fleagle, T., **Borcherding, N.**, & Hoffmann, D. (2017) Application of flipped classroom pedagogy to the human gross anatomy laboratory: student preferences and learning outcomes. *Anatomical Science Education*. PMID: 29283505.
- [36] Kolb, R., Phan L., **Borcherding, N.**, Liu, Y., Yuan, F., Janowski, A.M., Xie, Q., Markan, K.R., Li, W., Potthoff, M.J., Fuentes-Mattei, E., Knudsen, M., Lee, M., Yeung, S., Cassel, S., Sutterwala, F., & Zhang, W. (2016). Obesity-associated NLRC4 inflammasome activation drives breast cancer progression. *Nature Communications*. PMID: 27708283.
- [37] **Borcherding, N.***, Rudolph, M.*, Tierney, A.*, Vyn, R., & Hoffmann. (2016). Content evaluation, usage profile and student preferences related to a medical student wiki for student-authored learning resources. *Medical Science Educator*: 1-10. *co-primary authors
- [38] Kusner, D.*, **Borcherding, N.***, & Zhang, W. (2016) Paracrine WNT5A signaling in the mammary healthy and neoplastic mammary tissue. *Molecular & Cellular Oncology*. PMID: 27308558. *co-primary author
- [39] **Borcherding, N.**, Bormann, N., Kusner, D., Kolb R., & Zhang, W. (2015). Transcriptome analysis of basal and luminal tumor-initiating cells in ErbB2-driven breast cancer. *Genomic Data*. PMID: 26167451.
- [40] Schaefer, K., Toral, M., Velez, G., Cox, A., Baker, S., **Borcherding, N.**, Colgan, D., Bondada, V., Mashburn, C., Yu, C., Geddes, J., Tsang, S., Bassuk, A., & Mahajan, V. (2016). Calpain-5 expression in the retina localizes to photoreceptor synapses. *Investigative Ophthalmology and Visual Science*. PMID: 27152965.
- [41] **Borcherding, N.***, Kusner, D.*, Kolb, R., Xie, Q., Li, W., Yuan, F., Velez, G., Askeland, R., Weigel, R.J., & Zhang, W. (2015). Paracrine WNT5A Signaling Inhibits Expansion of Tumor-Initiating Cells. *Cancer Research*. PMID: 25769722. *co-primary authors
- [42] Mahauad-Fernandez, W.D.*, **Borcherding, N. C.***, Zhang, W., & Okeoma, C.M. (2015). Bone Marrow Stromal Antigen 2 (BST-2) DNA Is Demethylated in Breast Tumors and Breast Cancer Cells. *PLoS One*. PMID: 25393878. *co-primary authors
- [43] Reed, S.M., Hagen, J., Muniz, V.P., Rosean, T.R., **Borcherding, N.**, Sciegienka, S., Goeken, J.A., Naumann, P.W., Zhang, W., Tompkins, V.S., Janz, S., Meyerholz, D.K., & Quelle, D.E. (2014). NIAM-deficient mice are predisposed to the development of proliferative lesions including B-cell lymphomas. *PLoS One*. PMID: 25393878.
- [44] Xie, Q., Klesney-Tait, J., Keck, K., Parlet, C., **Borcherding, N.**, Kolb, R., Li, W., Tygrett, L., Waldschmidt, T., Olivier, A., Chen, S., Liu, G. H., Li, X., & Zhang, W. (2015). Characterization of a novel mouse model with genetic deletion of CD177. *Protein & Cell*. PMID: 25359465
- [45] **Borcherding, N.**, Kusner, D., Liu, G. H., & Zhang, W. (2014). ROR1, an embryonic protein with an emerging role in cancer biology. *Protein Cell*. PMID: 24752542.
- [46] Wu, X., Zhang, W., Font-Burgada, J., Palmer, T., Hamil, A. S., Biswas, S. K., Poidinger, M., **Borcherding, N.**, Xie, Q., Ellies, L. G., Ltyle, N. K., Wu, L. W., Fox, R. G., Yang, J., Dowdy, S. F., Reya, T., & Karin, M. (2014). Ubiquitin-conjugating enzyme Ubc13 controls breast cancer metastasis through a TAK1-p38 MAP kinase cascade. *Proceedings of the National Academy of Science*. PMID: 25189770.
- [47] Smazal, A. L.*, **Borcherding, N. C.***, Anderegg, A. S., Schalinske, K. L., Whitley, E. M., & Rowling, M. J. (2013). Dietary resistant starch prevents urinary excretion of 25-hydroxycholecalciferol and vitamin D-binding protein in type 1 diabetic rats. *Journal of Nutrition*. PMID: 23677864. *co-primary authors
- [48] Zhang, W., Tan, W., Wu, X., Poustovoitov, M., Strasner, A., Li, W., **Borcherding, N.**, Ghassemian, M., & Karin, M. (2013). A NIK-IKK α module expands ErbB2-induced tumor-initiating cells by stimulating nuclear export of p27/Kip1. *Cancer Cell*. PMID: 23602409.

Textbooks or Chapters

- [1] Kolb, R., **Borcherding, N.**, & Zhang, W. (2020). Understanding and targeting human cancer regulatory T cells to improve cancer therapy. T Regulatory Cells in Health and Disease. London, UK: *Springer Nature*. ISBN 978-981-15-6407-9
- [2] Zhang, W., **Borcherding, N.**, Kolb, R. (2019) IL-1 signaling in the tumor microenvironment. Tumor Microenvironment. New York City, NY: Springer International Publishing. ISBN: 978-3-030-34025-4.
- [3] Schalinske, K., **Borcherding, N.** Rowling, M. (2016). Advanced Nutrition and the Regulation of Metabolism. San Diego, CA: *Cognella Academic Publishing*. ISBN: 978-1-5165-1468-7

Software

Trex <https://github.com/ncborcherding/Trex>
Exigence <https://github.com/ncborcherding/exigence>
Escape <https://www.bioconductor.org/packages/release/bioc/html/escape.html>
scRepertoire <https://www.bioconductor.org/packages/release/bioc/html/scRepertoire.html>
TRGAted <https://nborcherding.shinyapps.io/TRGAted/>

Submitted Manuscripts

- [1] **Borcherding, N.**, Severson, K.J., Henderson, N., Ortolan, L., Rosenthal, A., Belizzi, A., Liu, V., Link, B.K., Mangold, A.R., & Jabbari, A. (2021). Comprehensive transcriptional and clonotypic analysis of peripheral blood in Sézary syndrome reveals novel expression markers and shifting gene profiles associated with treatment.
- [2] **Borcherding, N.**, Jia, W., Moley, J.R., Field, R.L., Ma, H., Pietka, T., Artyomov, M., Diamond, M., Abumrad, N., & Brestoff, J.R. (2021) Dietary lipids regulate transfer of adipocyte-derived mitochondria to a network of immune cells in white, beige, and brown fat.
- [3] Zhao, J. Xiu, Y., Fu, L., Dong, Q., **Borcherding, N.**, Wang, Y., Li, Q., Boyce, B., Klein, U., & Zhao, C. (2021). TIFAB Accelerates MLL-AF9-Induced Acute Myeloid Leukemia Through Upregulation of HOXA9.
- [4] Ceci, V., Turchi, R., Chuan, L., **Borcherding, N.**, Sánchez-Díaz, M., Fuoco, C., Audano, M., Sciarretta, F., Rosina, M., Arena, S., Tortolici, F., Palma, A., Riccio, F., Shamsi, F., Renzone, G., Verri, M., Crescenzi, A., Rizza, S., Faienza, F., Filomeni, G., Rufini, S., de Vries, A., Kooijman, S., Scaloni, A., Mitro, N., Tsent, Y., Hidalgo, A., Zhou, B., Brestoff, J. Aquilano, K., Lettieri-Barbato, D. (2021). Brown Adipocytes Transfer Damaged Mitochondrial Fragments to Macrophages to Avoid the Failure of Thermogenic Program.
- [5] Lasrado, N., **Borcherding, N.**, Arumugam, R., Starr, T.K., & Reddy, J. (2021). Dissecting the transcriptome Network and Cellular Heterogeneity in Viral Myocarditis by Single-Cell RNA Sequencing.
- [6] He, M., Roussak, K., Ma, F., Garin, V., Schutt, C., Jensen, T.I., **Borcherding, N.**, Zhao, Y., Bhatia, H., Korenfeld, D., Dinkel, S., Gray, J., Ulezko, A., Donoermeyer, D., Arlehamn, C., Gubin, M.M., Pellegrini, M., Sett, A., Tung, T., Bak, R. Modlin, R., Fieds, R.C., Shreiber, R.D., Allen, P.M., Klechevsky, E. (2021). CD5 Expression by dendritic cells directs T cell immunity and sustains immunotherapy response

- [7] Fujiwara, Y., Torphy, R.J., Miller, E.N., **Borcherding, N.**, Zhang, W., Schulick, R.D., & Zhu, Y. (2020). The BigLen/GPR171 pathway suppresses T cell activation and limits antitumor immunity.
- [8] **Borcherding, N.**, Crawford, M., & Karandikar, N. (2020) IL-17 cytokines preferentially act on naïve CD4+ T cells.

Research Funding

- 2017-2020** **NIH F30 CA206255**
 Paracrine non-canonical Wnt signaling in breast cancer
 Role: PI
- 2017** **Oberley Seed Grant for Experiment Therapeutics**
 Targeting mismatch repair for immunotherapy in basal-like breast cancer
 Role: Co-PI
- 2015-2016** **American Medical Association Foundation Research Seed Grant**
 Paracrine non-canonical Wnt signaling in breast cancer
 Role: PI

Invited Presentations

- [1] **Borcherding, N.**, Crotts, S., Ortolan, L., Bormann, N., & Jabbari, A. (2020, May). Single-cell mRNA sequencing of murine and human alopecia areata identifies immune cell profiles predictive of human disease state. Presented at the Academy of Clinical Laboratory Physicians and Scientists Annual Meeting in Iowa City, IA.
- [2] **Borcherding, N.**, Voigt, A., Liu, V., Link, B.K., Zhang, W., & Jabbari, A. (2019, May) Single-cell profiling of cutaneous T-cell lymphoma reveals underlying heterogeneity associated with disease progression. Presented at the Society for Investigative Dermatology Annual Meeting in Chicago, Illinois.
- [3] **Borcherding, N.**, Transcriptional Heterogeneity in cancer-associated regulatory T cells is predictive of survival. Presented at the Single-Cell RNA sequencing Symposium by the Iowa Institute of Genetics, Iowa City, Iowa.
- [4] **Borcherding, N.** Paracrine Regulation of Breast Cancer Tumorigenesis. (2016, April). Presented at the Midwestern Association of Graduate Schools Annual Conference in Chicago, Illinois.

National or Regional Conference Abstracts

- [1] Lasrado, N, **Borcherding, N.**, Arugmugam, R., Starr, T.K., & Reddy, J. Dissecting the complexity of heart infiltrates in post-infectious myocarditis induced with CVB3 infection by single-cell RNA sequencing analysis. (2021, May). Presented at the American Association of Immunologist Annual Meeting.
- [2] **Borcherding, N.**, Henderson, N., Ortolan, L., Liu, V., Link, B.K., Mangold, A., Jabbari, A. Comprehensive transcriptional and clonotypic analysis of peripheral blood in Sezary syndrome reveals novel expression markers and shifting gene profiles associated with treatment. (2021, May). Presented at the Society for Investigative Dermatology Annual Meeting.
- [3] **Borcherding, N.**, Henderson, N., Ortolan, L., Liu, V., Link, B.K., Mangold, A., Jabbari, A. Comprehensive transcriptional and clonotypic analysis of peripheral blood in Sezary syndrome reveals novel expression markers and shifting gene profiles associated with treatment. (2021, March). Presented at the United States and Canada Association of Pathology Annual Meeting.

- [4] **Borcherding, N.** Combining single-cell and AIRR data (2020, December). Presented at the Adaptive Immune Receptor Repertoire Society Annual Meeting.
- [5] Rauckhorst, A.J., **Borcherding, N.**, Kraus, A.S., Scerbo, D., & Taylor, E.B. (2020, September). Preserving the in vivo metabolome and energy-sensitive phosphoproteome requires rapid freezing of tissue samples. Presented at the Metabolomics Association of Northern America Annual Meeting.
- [6] **Borcherding, N.**, Crotts, S., Ortolan, L., Bormann, N., & Jabbari, A. (2020, May). Single-cell mRNA sequencing of murine and human alopecia areata identifies immune cell profiles predictive of human disease state. Presented at the Academy of Clinical Laboratory Physicians and Scientists Annual Meeting in Iowa City, IA.
- [7] Renavikar, P., Sinha, S., Brate, A., Crawford, M., **Borcherding, N.**, Steward, S. & Karandikar, N. (2020, May). Immune suppressive deficit in human Tc1 cells secondary to IL-12-induced pathways. Presented at the Academy of Clinical Laboratory Physicians and Scientists Annual Meeting in Iowa City, IA.
- [8] Hoffmann, D., Feagle, T., & **Borcherding, N.** (2020, April). Virtual Anatomy Videos for Pre-Lab Preparation: Does Usage Correlate with Grade Outcomes. Accepted to Experimental Biology Annual Meeting in San Diego, CA. (Canceled due to COVID-19).
- [9] Cole, K., Councilman, K., Zhang, W., & **Borcherding N.** (2020, March). WNT/ β -Catenin Signaling Correlates with Improved Survival in Luminal A Breast Cancer. Presented at the USCAP Annual Meeting in Los Angeles, CA.
- [10] Vishwakarma, A., **Borcherding, N.**, Chementi, M., Vishwakarma, P., Nepple, K., Salem, A., Jenkins, R.W., Zhang, W., Zakharia, Y (2019, November). Mapping immune landscape in clear cell renal carcinoma by single-cell genomics. Presented at the AACR Special Conference on Tumor Immunology and Immunotherapy in Boston, MA.
- [11] **Borcherding, N.**, Voigt, A., Liu, V., Link, B.K., Zhang, W., & Jabbari, A. (2019, May) Single-cell profiling of cutaneous T-cell lymphoma reveals underlying heterogeneity associated with disease progression. Presented at the Society for Investigative Dermatology Annual Meeting in Chicago, IL.
- [12] **Borcherding, N.**, Bormann, N., Zhang, W. (2018, January). Using data analytics to predict and improve cancer immunotherapy response. Presented at the American Physician Scientist Association Midwest Regional Meeting in Iowa City, IA.
- [13] **Borcherding, N.**, Jo, S., Zhang, W. (2017, October). Targeting mismatch repair for basal-like breast cancer. Presented at the Cancer Biology Training Consortium Annual Meeting in Portland, OR.
- [14] Feagle, T., **Borcherding, N.**, Hoffmann, D. Students Prefer 3D Anatomy Videos for Prelab Preparation Compared to Traditional Resources and Usage is Related to Class Performance. Presented at the annual Experimental Biology Conference in Chicago, IL.
- [15] Kolb, R., Kluz, P., Wei, T.Z., Bormann, N., **Borcherding, N.**, Markan, K., Pothoff, B., Tan, N.S., Sutterwala, F., & Zhang W. (2017, February). IL-1 β promotes obesity-driven breast cancer progression through the upregulation of Angptl4 in adipocytes. Presented at Inflammation-driven Cancer: Mechanisms to Therapy Keystone Symposia in Keystone, CO.
- [16] Schaefer, K.A., Toral, M., Velez, G., Cox, A., Baker, S., **Borcherding, N.**, Colgan, D.F., Smits, M.M., Bondada, V., Mashburn, C.B., Yu, C., Geddes, J., Tsang, S.H., Bassuk, A.G., Mahajan, V.B. (2016, June). Calpain-5 expression in the retina localizes to photoreceptor synapses. Presented at the FASEB Conference for The Biology of Calpains in Health and Disease in Big Sky, MT.
- [17] Kolb, R., Phan, L., **Borcherding, N.**, Liu, Y., Yuan, F., Janowski, A.M., Xie, Q., Markanm K., Li, W., Pothoff, M., Fuentes-Mattei, E., Ellies, L., Knudson, M., Lee, M., Yeung, S., Cassel, S.,

- Sutterwala, F., & Zhang, W. (2016, January). Obesity-induced Nlrc4 inflammasome promote angiogenesis in breast cancer. Presented at the AACR Special Conference: The Function of Tumor Microenvironment in Cancer in San Diego, CA.
- [18] Kolb, R., **Borcherding, N.**, Liu, Y., Yuan, F., Xie, Q., Sutterwala, F., Zhang, W. (2015, April). NLRC4 inflammasome promotes breast cancer progression in diet-induced obese mice. Presented at the American Association for Cancer Research Annual Meeting in Philadelphia, PA.
- [19] **Borcherding, N.**, Kusner, D., Kolb, R., Xie, Q., Zhang, W. (2015, April). Paracrine Wnt5a signaling inhibits the expansion of tumor initiating cells via Ryk/TGF β R/Smad2. Presented at the ASCI/AAP/PSA Annual Joint Meeting in Chicago, IL.
- [20] **Borcherding, N.**, Kusner, D., Kolb, R., Xie, Q., Zhang, W. (2014, April). Wnt5a/ROR1 Axis in Triple Negative Breast Cancer Progression and Potential Therapy. Presented at the American Association for Cancer Research Annual Meeting in San Diego, CA.
- [21] Kolb, R., Liu, Y., Xie, Q., **Borcherding, N.**, Li, W., Zhang, W. (2014, April). Inflammasome activation in obesity-associated breast cancer progression. Presented at the American Association for Cancer Research Annual Meeting in San Diego, CA.
- [22] Xie, Q., **Borcherding, N.**, Kolb, R., Zhang, W. (2014, April). CD177, A novel Metastasis Suppressor of Breast Cancer. Presented at the American Association for Cancer Research Meeting, San Diego, CA.

Academic Service

2019-2020	Alpha Omega Alpha Selection Committee, <i>Carver College of Medicine, University of Iowa</i>
2016-2017	LCME Accreditation Review Taskforce, <i>Carver College of Medicine, University of Iowa</i>
2016-2017	Medical Education Council, <i>Carver College of Medicine, University of Iowa</i>
2016-2017	First Aid/USMLE _{rx} Student Council
2015-2018	Presidential Charter Committee for Recreational Services, <i>University of Iowa</i> Served as Chair 2017-2018
2014-2018	University of Iowa Research Council, <i>University of Iowa</i>
2013-2016	Graduate and Professional Student Government, <i>University of Iowa</i>
2013-2014	Graduate Student Senate, <i>Department of Pathology, University of Iowa</i>

Selected Awards and Honors

2021	Paul E. Strandjord Young Investigator Award, <i>Academy of Clinical and Laboratory Physicians and Scientists</i>
2020	Williams L. Roberts Young Investigator Award with Distinction, <i>Academy of Clinical and Laboratory Physicians and Scientists</i>
2020	Special Achievement in Pathology, <i>Iowa Pathology Society</i>

- 2020** Teaching Distinction
Carver College of Medicine, University of Iowa
- 2019** Alpha Omega Alpha Honor Medical Society Induction
Carver College of Medicine, University of Iowa
- 2018** Finalist, Graduate Research Excellence Award in Biological Sciences
University of Iowa
- 2018** Hancher-Finkbine Medallion for Leadership, Learning and Loyalty
University of Iowa
- 2017** Wilderness Medicine Race Winner
Carver College of Medicine, University of Iowa
- 2017** Richard G. Lynch, MD Award for Pathology Research
Carver College of Medicine, University of Iowa
- 2017** Research Award in Cancer
Carver College of Medicine, University of Iowa
- 2017** Wilderness Medicine Race Winner,
Carver College of Medicine, University of Iowa
- 2015** Member, ProQuest Hall of Scholars,
- 2015** Distinguished Thesis Award, Biological/Life Science,
Midwestern Association of Graduate Schools
- 2015** L.B. Sims Outstanding Master's Thesis Award in Biological Sciences,
Graduate College, University of Iowa
- 2015** Richard G. Lynch, MD Award for Pathology Research,
Carver College of Medicine, University of Iowa
- 2014** Richard G. Lynch, MD Award for Pathology Research,
Carver College of Medicine, University of Iowa
- 2013** Research Award in Cancer,
Carver College of Medicine, University of Iowa
- 2012** Departmental Scholarly Achievement Award
Department of Food Science and Human Nutrition, Iowa State University
- 2012** University Graduation Marshall
Iowa State University
- 2012** Graduation Ceremony Student Address
Iowa State University
- 2005** Eagle Scout
Boy Scouts of America

Military Experience

Sergeant, Infantry

May 2007 – May 2013

United States Marine Corps

- Served in Operation Iraqi Freedom II
- Served as Platoon Sergeant, Squad Leader, Fire Team leader

Promotions

2012 Sergeant

2011 Corporal

2008	Lance Corporal
2007	Private First Class